

**Second Report of the
International Technical Working Group
For the
European Grape Vine Moth (EGVM) in California
FINAL---MAY 14, 2010**

A subset of the International Technical Working Group (TWG) for the European Grapevine Moth (EGVM) program in California met in Napa, California on April 14 and 15, 2010. TWG members attending: V. Mastro (Chair), R. Cardé, D. Lance, A. Lucchi, L. Sazo, R. Steinhauer, and L. Varela. The following members could not attend, due primarily to logistical reasons: B. Bagnoli, G. Wegner-Kiss, C. Ioriatti, G. Barrios, and R. Sforza.

Situation at the time of the meeting: EGVM was identified as the cause of severe damage in several vineyards in Napa County in the late summer of 2009. Traps were deployed but most of the population had apparently gone into diapause and only a handful of moths were captured in 2009. EGVM and the associated *Botrytis* infections caused complete loss of harvest from two vineyards (fields) in 2009 and unacceptable tainting of wine made from grapes of another vineyard. Damage that, in retrospect, has been attributed to EGVM was observed in those fields as early as 2007, and yields in the most heavily damaged vineyard has been declining steadily since 2005.

Delimitation trapping grids were placed out in Napa and surrounding counties in the spring of 2010. The program captured nearly 1000 moths in these traps by mid-April. In a separate trapping test in one heavily infested field, individual traps caught several hundred males each in the week before the meeting. The delimitation results suggested a major center of infestation in the Oakville area with a second smaller center in Napa 2-3 miles east of the downtown area. Smaller numbers of moths were captured in several other Napa County locations, and a single moth was caught in Sonoma County.

Background: All members of the TWG believe that EGVM represents a serious threat to grape-growing industries in California and beyond. EGVM is a key pest of grape in Europe; i.e., it often requires application of control measures, and those measures at times can result in flare-ups of secondary pests. The TWG was told that insecticide use in Napa vineyards is typically light and most grapes come to maturity with no insecticide applications. The long-term presence of EGVM in Napa would require intensive management and effectively impose a “tax” on growers. The local growers and Napa County officials appear to be firmly behind efforts to mitigate the effects of the pest.

Overall strategy: While it is premature to lock into a fixed strategy or goal for the EGVM program in Napa, the TWG agreed that the program should proceed at this point as if eradication was the goal. To do so will leave all options on the table for future consideration. Eradication, in fact, will be a realistic goal for the program if (1) the population is not (and does not become) substantially more widespread than it is known to be at present, (2) the grape industry remains behind the effort, and (3) control methods that are available at the present time remain available for use by the program. Those methods include insecticides (insect growth regulators and more conventional products as well as organic alternatives such as spinosad and Bt), mating disruption (currently only available in hand-applied formulations), and the removal of fruit and flowers from grape vines. Proceeding, at this time, as if eradication is the program goal will also tend to minimize regulatory issues associated with the risk of moving EGVM to uninfested areas on loads of grapes post-harvest.

Initial control efforts will consist of ovicides and/or larvicides applied by growers to infested vineyards, followed by mating disruption applications. At this point, enthusiasm for the project appears high among

growers and a coordinator is doing a good job of ensuring proper timing, methods and materials. However, at this point, grower participation is voluntary. If this program moves fully towards eradication, a well-coordinated, area-wide effort will be needed to ensure success. Populations could persist and build in vineyards of a small minority of growers who choose not to participate, jeopardizing the entire project. In addition, treatment areas will have to encompass all habitats that may contain EGVM hosts, including urban and riparian (or other wild) portions of the infested area. The program should explore possible mechanisms of ensuring compliance among growers and other members of the public and/or seek funding and authority to apply control measures on an area-wide basis as part of program operations.

Answers to specific questions posed to the TWG:

Biology –

1. *Host relations.* Several questions boiled down to “what host plants other than grape may be of concern, and at what time of year?” The TWG members agreed that grapes are the major concern, and that EGVM is rarely found on other hosts, though inflorescences of some hosts may be infested by larvae of the first annual generation. An exception is *Daphne*, *D. gnidium* in particular, which is thought to be the ancestral host of EGVM. Olive, which is common in the Napa area, has a variable track record as a host in Europe. Olive flowers are reportedly used by first-generation EGVM in Greece (there are a few additional scattered reports), but are not generally infested in Italy or France. The reason for this regional difference is unknown; there was some speculation about the relative timing of flowering in olive vs. grape in the different regions. The status of olive as a host in California is yet to be determined, though it was seen as very unlikely to support year-around reproduction of EGVM.

U.S. regulations list treatments for EGVM on a number of other hosts, including apple, avocado, pear, and quince. TWG members from EGVM-infested areas did not believe any of these are of concern as hosts. CPHST will inquire as to why EGVM treatments are listed for these crops.

Wild grapes, including indigenous and “feral” varieties, are reportedly common in the Napa area, including along waterways, and will need to be considered in designing EGVM management schemes, especially if eradication is the end goal.

Overall, alternate hosts in the Napa area will need to be better understood as the program moves forward (see Research Needs).

2. *Movement in soil.* Overall, the risk of EGVM being moved in soil adhered to farm equipment was viewed as very low. Despite this, the TWG recommends that all farm equipment be cleaned (e.g., power-sprayed or steam-cleaned) before moving between vineyards. Note also that EGVM life stages can potentially be carried on equipment without soil.

3. *Second-crop grapes* (this issue was brought up by TWG members and not posed by the program). TWG members from EGMV-infested areas indicated that the insects will infest second-crop grapes. This should be considered in management plans and communicated to growers and pest control advisors.

Regulatory recommendations –

1. *Nursery stock.* For grape nursery stock produced within the regulated zone: (1) vines shall be kept free of flowers and berries (this is especially critical if vines are shipped in potting medium rather than bare root); (2) rootstock and scion wood cuttings, as well as dormant rootings and bench-grafted vines, shall be treated with a hot water dip (5 min at 127° C [52.7° F]); (3) if nursery stock is to be shipped outside the regulated area, it should also be inspected and found to be free of *Lobesia* prior to shipment.

2. *Grapes for crushing.* The TWG recognizes the need for growers to move grapes to their contracted processors and that undue restrictions on movement of grapes would be a serious burden on the industry. At the same time, the experience in Chile indicates that moving grapes even from very lightly infested vineyards (with no apparent population) into uninfested areas for crushing can start infestations that then

spread into surrounding areas. Stopping human-mediated, long-range spread of this insect is absolutely essential for meeting program goals. The TWG recommends that specific regulations are put into place, with measures to ensure compliance, to ensure that when grapes are moved to processing facilities, the resulting risk is minimal. If grapes are to be moved out of regulated areas:

- Vineyards in the regulated area that are moving grapes out of the regulated area for processing must be inspected and found to be apparently free of EGVM prior to harvest. Inspection methods shall include sampling of grape clusters for larvae, as many vineyards will likely be under mating disruption, such that attraction of moths to traps in the area will be greatly reduced. Details of inspection protocols and timelines need to be worked out, specified (see Research Needs), and communicated to growers well ahead of harvest. Program leadership should provide information on alternative processing areas and facilitate options in the case that some growers have trouble producing EGVM-free grapes.
- Trucks or containers holding grapes must be covered with screen or tarps to minimize escape of adults and/or larvae. Screening may be preferred in some cases to minimize heating of grapes during transport. Mesh size must be small enough to prevent escape of EGVM larvae and adults (see Research Needs).
- All containers and the truck bodies will be thoroughly cleaned at the processing facility. The method (e.g., pressure-washing, steam-cleaning) would be at the discretion of the facility but must be demonstrated to be effective.
- Loads from the quarantine area shall be given priority at the processing facility. The TWG discussed a maximum wait time but did not reach consensus.
- All equipment leaving fields from within the infested area shall be cleaned (again, method is up to grower but must have been demonstrated to be effective). This one is not specifically about moving grapes to the crush facility but applies before, during, and after the harvest.
- Winery waste must be disposed of in a manner that prevents survival of any life stages of EGVM. Winery waste in this context includes all materials other than grapes; i.e., leaves, stems, culls, leaf litter, and any other unprocessed or uncrushed material. In addition, unfermented pomace should be considered a risk until proven otherwise (see Research Recommendations). Acceptable disposal methods include: (a) composting materials on site in accordance with California Code of Regulations, Title 14, Division 7, Chapter 3.1, Section 17868.3 (the program should provide this Code to the receivers and answer any questions the receivers may have); (b) processed (chipped, ground or shredded--details for acceptable processing methods need to be specified); (c) held in an approved green waste container prior to being transported to a facility under compliance with the Program; (d) transported by a green waste hauler under compliance with the Program; (e) treated otherwise in a manner approved by the Program (heat treatment, for example, may be a future option). Methods must be shown to be effective prior to use. Material that has been fermented is exempt.

The TWG discussed a 2-tiered approach to this; what is described above would apply to grapes being moved from within the regulated area to processing facilities outside of that area. For grapes being moved from vineyards within the area known to be infested (within vineyards and other habitats where moths have been captured or other life stages have been found in fields, as well as areas surrounded by fields known to be infested) to areas that are not known to be infested but are within the regulated area, less stringent measures would apply, but would still involve safeguarding loads, rapid processing of grapes from within infested areas, and likely some monitoring of populations within fields.

The TWG is optimistic (and believes, based on the experience in Chile) that if growers judiciously follow recommendations regarding application of control measures in their vineyards, populations will be reduced to the point where disruption of normal harvesting and grape processing operations will be minimal.

Treatments for commercial areas –

Grape growers within the infested area, under coordination by Napa County (recent spread to additional counties may require other options), have initiated an intensive and coordinated program to drastically reduce EGVM populations through the use of insecticides and mating disruption. The TWG applauds this effort with the caveat that, as the program progresses, it may be desirable to move from voluntary compliance to mandatory in order to meet program goals.

The TWG also recommends that an assessment component be incorporated into the program to track the use of control measures (when and where) and their effectiveness within the same generation targeted by the measures.

Insecticides: Properly timed applications of insecticides that function as ovicides and/or larvicides should be applied at least to the first two generations. If insecticides are applied to the last generation of the summer, ovicidal properties and proper timing become critical, as larvae feed within large bunches of grapes and thus are difficult to reach with insecticides. For conventional growers, insect growth regulators such as methoxyfenozide (“Intrepid”) have proven very effective against EGVM in other areas and are less toxic to many non-target organisms than conventional neurotoxins. For organic growers, TWG members from EGVM-infested countries report that spinosads are the materials of choice, although Btk is an alternative. All vineyards within known infested areas, as well other areas containing potential hosts, should be treated. The program should also recommend treating areas with grapes and other hosts for to a distance of up to 1000 m beyond the areas that are known to be infested. Treatment of this band beyond the known infestation should be done with insecticides only to avoid reducing the effectiveness of detection traps in those areas; much smaller buffer zones are recommended for mating disruption (see below). The program should consider treating olives during the first generation if olives are found to host EGVM in California, and should pursue registration or exemption to use spinosads or Bt for that purpose.

Mating disruption: Mating disruption treatments should be applied, to the degree possible, to all vineyards within the known infested area. The TWG recommends against using mating disruption as a “prophylactic” treatment beyond the known infested area as it will seriously compromise the detection capability. However, riparian and other non-crop areas within the known infested zone should be treated if there is a chance they contain EGVM hosts. In addition, mating disruption functions best when applied across broad areas; small treatment blocks should be expanded to a minimum of 10 acres, and small buffers (25-30 m) can be applied where practical beyond the edges of treated areas.

Mating disruption treatments should, in 2010, be in place before emergence of adults of the second generation. This probably means by late May, though monitoring should be used to ensure proper timing. Treatments should remain in place throughout the season until EGVM enters diapause. If mating disruption formulations are in limited supply, priority should be given to core areas with very high populations, organic growers (as their insecticides will likely be somewhat less effective than those of conventional growers), and population centers that are remote from the generally infested area. In future years, mating disruption treatments should be in place prior to emergence of the overwintering population.

Treatment plan for non-commercial areas –

Due to time constraints, there was minimal discussion on this subject at the TWG meeting. CDFA had suggested treating within a 200-m radius of positive traps with multiple treatments of Btk and mating disruption. A few comments:

- TWG members with EGVM management experience felt that spinosad would generally be more effective than Bt. Spinosad formulations are available that are compatible with organic production.

- Host removal (whole plants or susceptible tissues such as grape flowers and berries) should be considered as an adjunct to, or, for environmentally (or socially) sensitive areas, in lieu of insecticide treatment.
- While it's assumed that spaces between adjacent positive traps would be "filled in" by program activities, the program should consider using radial distances that at least cover the area between traps (and 200 m often will not). One possibility is to use the distance between traps on a perfectly evenly spaced grid (i.e., where each trap is at the center of a circle of six traps that are evenly spaced along the circle). While such uniform spacing will never exist in a real program, the distance will likely reach at least half way from a given trap to each surrounding trap in the majority of instances. That distance (d), in meters, is described by the formula $d = 1729/(\text{sqrt}(n))$, where n is the number of traps per square mile. At 16, 25, and 49 traps per square mile, d is approximately 430, 350 and 250 m, respectively.

Trapping and regulatory zones –

Reduce trapping to 7 traps per square mile within known infested areas. Maintain trapping at 25 traps per square mile in areas that are not within the known infested area but are within the regulated area.

It is not necessary to require identification (by official identifiers) of moths captured within the area that is known to be infested. Similarly, requiring official identification of moths captured in such efforts as testing traps and lures, monitoring phenology, and evaluating effectiveness of control treatments can place an unnecessary burden on both the identification system and persons performing the trapping.

The original TWG recommendation for the regulated zone was 5 to 10 miles beyond the known infested area. This was based on uncertainty about the actual area infested by the moth. Some of that uncertainty still exists. Regardless, for a variety of reasons, the program is regulating to 3 miles beyond the known infested area. The TWG recommends bumping the regulated zone back out to 5 miles. This will help ensure that any as-yet-undetected infestations at the outer edge of the generally infested area will not be inadvertently moved to more remote locations prior to detection. If field managers want to use traps to monitor for EGVM in their fields, they should be asked to keep them at least 30-40 m from program traps to minimize interfere with (i.e., "poaching" moths from) those traps. Managers who place traps should also be encouraged to submit their trapping data to the program.

Research needs

(not prioritized, though items in **bold** are short-term needs)

Monitoring:

- optimize pheromone "blend" and lure loading for trapping and detection.
- **develop sampling systems for assessing populations of immature EGVM in fields (for use in monitoring to assess risk of moving grapes out of quarantine zone for crush).**
- optimize trap design.
- determine sensitivity of the detection and delimitation systems (would have to be done abroad at this point).

Ecology, behavior, biology, biological control:

- **Determine what alternative hosts are used by EGVM in California.**
- Evaluate genetic diversity in EGVM.
- Characterize adult behavior (flight, mating, oviposition, resting).
- Evaluate possibility of using biological control agents to reduce populations.
- Characterize population dynamics of EGVM in California, including effects of natural enemies.
- Develop a spread model.

Control:

- Develop plan to evaluate area-wide control efforts, starting in 2010. The plan should include recording of data on treatments and tracking of EGVM populations within a subset of treated field in core infested areas. This evaluation should include collection of green and ripe fruit from each field to determine damage levels during the second and third generations.
- Develop/assess new mating disruption formulations for EGVM, including machine-applied.
- Develop lists of “best” insecticides for use in conventionally managed vineyards, organic vineyards, and sensitive areas (e.g., riparian, urban and suburban areas). Fill gaps where necessary by testing new or alternative chemicals.

Develop Sterile Insect Technique (SIT) methodology for EGVM:

- improved rearing technology.
- radiation biology – identify dose and methods for producing fully sterile and F1-sterile male EGVM.
- develop release technology.
- evaluate field competitiveness of sterile moths.

Regulatory:

- **Develop and/or confirm regulatory treatments for grapes (table, wine, raisin).**
- Develop regulatory treatments for grape nursery stock; confirm efficacy of hot-water dip.
- Investigate pathways that could move EGVM to new areas. Also, how did it get to Napa?
- **Identify screening that can be used to retain EGVM adults and larvae in grapes being transported (without causing overheating).**
- **Confirm efficacy of/develop improved methods for handling, composting, or otherwise treating winery waste to minimize risk.**
- **Determine if EGVM life stages can survive the crush process and survive in unfermented pomace.**
- **Confirm that processing grapes into raisins will kill all EGVM life stages.**

Economic assessment of EGVM in California and North America